

NEW AUSTRALIAN FISHES. PART 11.
A NEW GENUS AND SPECIES OF ELEOTRIDID (GOBIOIDEI)
FROM SOUTHERN AUSTRALIA WITH A DISCUSSION OF RELATIONSHIPS

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Abstract

Hoese, D.F. and Larson, H.K. 1987. New Australian fishes. Part 11. A new genus and species of eleotridid (Gobioidei) from southern Australia with a discussion of relationships. *Mem. Mus. Vict.* 48: 43-50.

Thalasseleotris adela is described as a new genus and species of eleotridid fish from marine waters of southern Australia. Individuals of the monotypic genus are among the smallest eleotridid fishes known. The genus is one of three truly marine genera in the family and is peculiar in superficially resembling a gobiid. It is distinctive in lacking head pores, in having a single pterygiophore before the first haemal arch, and in having the first gill slit closed by a membrane to the inner gill cover. Although superficially similar to other temperate eleotridid genera, it has several primitive features, not found in many of the more specialised Australian genera and immediate relatives are unknown. The species, distributed from New South Wales throughout southern Australia to south-western Western Australia shows considerable geographical variation in pectoral-ray counts.

Introduction

Few genera of gobioid fishes are confined to temperate regions of Australia. Two gobiid genera are found only in southern waters, with *Tasmanogobius* restricted to Victoria, Tasmania and South Australia, and *Nesogobius* restricted to southern New South Wales, Victoria, Tasmania, South Australia and southern Western Australia. Similarly, few temperate eleotridid genera are known from Australia. *Philypnodon* is restricted to fresh waters and coastal estuarine lakes of southern Queensland, New South Wales, Victoria and South Australia, while *Gobiomorphus* is restricted, in Australia, to coastal rivers of southern Queensland, New South Wales and eastern Victoria. *Gobiomorphus* occurs in New Zealand.

In 1972 a small gobioid that was thought to be related to *Heteroleotris* was collected from Tasmania. This relationship was based on its general similarity in body form to *Heteroleotris* and other morphological similarities. Both genera have 10/17 vertebrae and the first gill slit closed. Study of the osteology, however, revealed that the species has several primitive features not known in

any gobiid fish. The species was subsequently found to be widespread in southern Australia in marine rocky reef areas from Sydney, New South Wales, to Rottneest Island, Western Australia.

Methods

The first dorsal pterygiophore formula follows Birdsong (1975). In descriptions and the tables, an asterisk indicates the value is that of the holotype, figures in brackets in the text indicate the number of specimens examined with the preceding value. In the *Material examined* list the number of specimens is given following the registration number and the size range in mm standard length is given in parentheses. Counts and measurements mostly follow methods outlined by Hubbs and Lagler (1958). In the species studies, the first ray of the anal fin and second dorsal fin is always a spine. The remaining rays in these fins are segmented. The last ray of the second dorsal and anal fins, as counted, consists of two elements in contact though distinct through the extreme base. Segmented caudal ray

count is of total segmented rays, and in most specimens there are eight dorsal and eight ventral rays. Unsegmented caudal rays are recorded as dorsal/ventral rays. Longitudinal scale counts (LS) are taken along the midline of the sides of the body, from the upper base of the pectoral fin to the end of the hypural, excluding small scales on the base of the caudal fin. Transverse scale counts are taken from the anal spine upward and backward to the base of the second dorsal fin (TRB). Vertebrae are counted from radiographs. Caudal vertebrae are defined here as those with a closed haemal arch and a developed haemal spine. Generally in gobioids, one or two anal pterygiophores precede the first haemal spine (whether one or two depending on the genus). The osteology was studied from trypsin prepared cleared specimens, stained with alizarin red and in some cases, counterstained with alcian blue.

Papillae were studied from cleared and stained material and untreated specimens (Hoesé, 1983). The papillae line terminology follows Hoesé (1983). The abbreviation LT refers to a more or less horizontal line, with each papilla axis at right angles to the axis of the line; LL refers to a more or less horizontal line, with each papilla axis along the axis of the line; VT refers to a more or less vertical line with each papilla axis at right angles to the axis of the line. The term OT is used specifically for the oblique lines on the operculum, with each papilla axis at right angles to the axis of the line.

Material is deposited in: Australian Museum, Sydney (AMS); Laboratory of Ichthyology, Crown Prince's Palace, Tokyo (LICPP); Museum of Victoria, Melbourne (NMV); Northern Territory Museum of Arts and Sciences, Darwin (NTM); Queen Victoria Museum, Launceston (QVM); South Australian Museum, Adelaide (SAMA) and Western Australian Museum, Perth (WAM).

Thalasseleotris gen. nov.

Type species. Thalasseleotris adela sp. nov.

Diagnosis. Gill opening broad, gill membranes attaching to isthmus below posterior quarter of eye; membranes forming free fold across isthmus. Vertebrae 10/17. Tongue tip deeply bilobed. First gill slit closed by membrane from lower part of first gill arch to inner gill cover. Head subterete,

body covered with ctenoid scales, cycloid on belly. Mouth small, posterior end of jaws reaching to point ventral to middle to posterior quarter of eye. Pelvic fins completely separate, with no basal membrane. Pterygiophore formula 3(22110) in 6, 3(212110) in 1. Segmented caudal rays usually $8+8=16$. Tendon from adductor mandibulae attaching anteriorly and ventrally on inner side of maxilla in front of maxillo-dentary ligament. Single pterygiophore preceding first haemal arch.

Osteology. Typical eleotridid features. Palatine more or less L-shaped, with short dorsal flange articulating with middle of anterior part of lateral ethmoid. Branchiostegal rays 6.

Primitive butine features. Tendon from adductor mandibulae attaching anteriorly on inner face of maxilla, slightly anterior to maxillo-dentary ligament. Caudal fin usually with 8 dorsal (rarely 9) and 8 lower segmented rays uppermost articulates with hypural 5; 7 segmented rays articulating with upper hypural plate, 6 segmented rays articulating with lower hypural plate, 1 segmented caudal ray articulating with parhypural lowermost articulating with haemal arch of penultimate vertebra.

Specialisations. No mesoptrygoid. Dorsal and ventral postcleithra absent. Maxillo-dentary ligament attaches to distinct process on outer face of maxilla. Urohyal without transverse shelf on ventral margin (broad in most eleotridids). Basihyal triangular, broader than long. Scapula ossified dorsally, cartilaginous ventrally. Epurals 1. Interneural gap (interneural space without pterygiophore) between 2 dorsal fins. Frontal very narrow between orbits. Single pterygiophore precedes first haemal spine.

Other features. Pelvic-intercleithral and ventral intercleithral cartilages present. Lower hypural plate with articulation joint connecting to urostyle but not fused with urostyle or upper hypural plate. Pterygiophore formula 3(22110). Preoperculum broad adjacent to symplectic, but without process connecting to upper end of symplectic. Symplectic slender. Metapterygoid broad, separated by cartilaginous rod from quadrate. Lacrimal elongate and triangular, overlapping middle of maxilla. Dorsal flange of sphenotic short not reaching supraoccipital.

Etymology. From the Greek *thalassa* (sea) and *Eleotris* (a genus of fish), feminine.

Remarks. In the presence of the interneural gap, the absence of postcleithra and mesoptrygoid, the genus is similar to other temperate Australian eleotridids, such as *Philypnodon* or *Gobiomorphus*. However, these latter genera are specialised in having the tendon from the adductor mandibulae attaching to near the middle of the maxilla and 15 segmented caudal rays. In *Philypnodon* the dorsal postcleithrum is present, and in some species of *Gobiomorphus* the dorsal postcleithrum and mesoptrygoid are present. Similarly in *Hypseleotris* the mesoptrygoid is present only in some species. Both the mesoptrygoid and dorsal postcleithrum are poorly developed in most eleotridid genera and presumably these structures have been lost several times.

The genus is unique among eleotridids in having a single pterygiophore before the first haemal spine, very narrow interorbital, and a broad membrane closing the first gill arch. A partial membrane is developed in some eleotridids, such as in *Eleotris acanthopoma*.

Studies currently underway by the senior author indicate that the jaw musculature is unlike that of other eleotridids. Consequently, its relationships are, at present, uncertain.

Thalasseleotris adela sp. nov.

Figures 1-4

Material examined. Holotype. Tasmania, 3 km north of Norfolk Creek, north of Port Arthur (43°00'S, 147°46'E), 1-2 m, D. Hoese and W. Ivantsoff, 2 Dec 1972, AMS I.17550-010, (25 mm SL female).

Paratypes. New South Wales. Oakes Bay, Port Hacking, 1-2 m, NSW Fisheries, CSIRO and Australian Museum party, 14 Nov 1974, AMS I.18241-017, 23 (9-28); AMS I.18241-035, 4 (20-26), cleared and stained; NTM S.11905-001m 4 (18-28).

Victoria. Melbourne, R. Kuitert, 9 Jun 1976, AMS I.19178-001, 2(25-26). Portsea Pier, Port Phillip, 3-4 m, R. Kuitert and L. Reynolds, 12 Apr 1977, AMS I.19773-010, 3(22-25). Portsea Pier, Port Phillip, R. Kuitert, 30 Jul 1977, AMS I.19921-001, 1(19). Portsea Hole, 20-25 m, R. Kuitert, NMV A.3821, 1(26). Portsea, 4 m, R. Kuitert, 12 Jul 1981, NMV A.3820, 6(22-28). Portsea, R. Kuitert, NMV A.2684, 4(24-27).

Tasmania. Type locality, AMS I.17550-014, 11(18-31). Port Arthur, 1 m, D. Hoese and W. Ivantsoff, 2 Dec 1972, QVM 1986/5/8, Type No. 429, 1(25). Mundy Island, Port Davey, J.B. Hutchins, 1 Feb 1982, WAM P.27542-004, 1(18). Port Davey, J.B. Hutchins, 1982, WAM P.27543-005, 1(30). Hope Island, Port Esperance, J.B. Hutchins, 6 Feb 1982, WAM P.27544-014, 4(21-22). 3 km north of Esperance Point, Port Esperance, J.B. Hutchins, 9 Feb 1982, WAM P.27546-012, 8(13-22). Hope Island, Port Esperance, J.B. Hutchins, 1982, WAM

P.27547-007, 6(22-25). Port Arthur, J.B. Hutchins, 1982, WAM P.27549-015, 3(22-23). West headland of Spring Bay, J.B. Hutchins, 1982, WAM P.27554-018, 4(19-22). Skeleton Bay, St Helens, J.B. Hutchins, 24 Feb 1982, WAM P.27555-011, 4(19-20). Bridport, J.B. Hutchins, 1982, WAM P.27564-014, 4(13-21).

South Australia. Western River Cove, Kangaroo Island, 15 m, D. Hoese and party, 3 Mar 1978, AMS I.20160-020, 6 (15-26). Vivione Bay, Kangaroo Island, 0-2 m, D. Hoese and K. Handley, 6 Mar 1978, AMS I.20171-020, 1(22). Knob Point, Kangaroo Island, 0-2 m, H. Larson and party, 5 Mar 1978, SAMA F.5489, 1(21). Off Kings Beach, Victor Harbour, J.B. Hutchins, 1981, WAM P.27136-015, 3(21-25).

Western Australia, Rottnest Island: Fish Hook Bay, 11 m, J.B. Hutchins, 11 Apr 1978, WAM P.26060-016, 2 (16-20). 300 m north of Point Clune, 8 m, J.B. Hutchins and party, 7 Jun 1980, WAM P.26616-025, 2(24-24). Off Geordie Bay, 5 m, J.B. Hutchins, 14 Jun 1980, WAM P.26620-023, 3(15-20). Fish Hook Bay, J.B. Hutchins, 1984, WAM P.27616-033, 1(20).

Western Australia, Recherche Archipelago: Sandy Hook Island, B. Hutchins and Bryce, 11 Apr 1977, WAM P.25570-022, 1(24). West side of Mondrain Island, 10-13 m, J.B. Hutchins, 18 Mar, 1978, WAM P.26005-011, 1(20). East side of Lucky Bay, 5-7 m, J.B. Hutchins, 12 Apr 1984, WAM P.28293-033, 9(15-22). East side of Mondrain Island, 5-6 m, J.B. Hutchins, 13 Apr 1983, WAM P.28296-047, 6(19-25). East side of Lucky Bay, 8-10 m, J.B. Hutchins, 14 Apr 1984, WAM P.28297-025, 2(12-22). Lucky Bay, 24 m, J.B. Hutchins, 18 Apr 1984, WAM P.28298-017, 1(21). East side of Lucky Bay, 11-12 m, J.B. Hutchins, 16 Apr 1984, WAM P.28300-028, 3(12-23).

Non-type material. New South Wales. Port Hacking, LICPP ex AMS I.18241, 6(20-21).

Tasmania. Esperance Point, Port Esperance, WAM P.27545-009, 5(18-23). Point Homes Lookout, Mercury Passage, WAM P.27553-020, 1(13).

Western Australia, Rocky Cape, WAM P.27569-019, 1(12). West side of Lucky Bay, Recherche Archipelago, WAM P.26000-018, 2(14-210). East side of Lucky Bay, Recherche Archipelago, WAM P.26001-008, 2(14-22).

Diagnosis. No head pores. Second dorsal usually 1, 9; anal usually 1, 8; pectoral usually 18-20; pelvics 1, 5, fifth ray highly branched with 4-6 branches. Yellow to dark brown stripe from anteroventral margin of eye to just above middle of premaxilla. Elongate yellowish to black blotch directly below eye extending to posterior end of jaw (faint in some preserved material). Dark vertical bar at base of caudal fin.

Description. First dorsal V(1), VI*(59), VII(1); second dorsal I,9*(58), 1,10(3), anal I,8(2), 1,9*(57); pectoral rays 17-21 (Table 1), pelvic rays 1, 5*(61); segmented caudal rays 15(7), 16*(38), 17(9); branched caudal rays 13*(21), 14(24), 15 (4), 16(1); unsegmented caudal rays 8/6 (1), 7/6 (5); vertebrae 10/17* (18), longitudinal scale series 22-

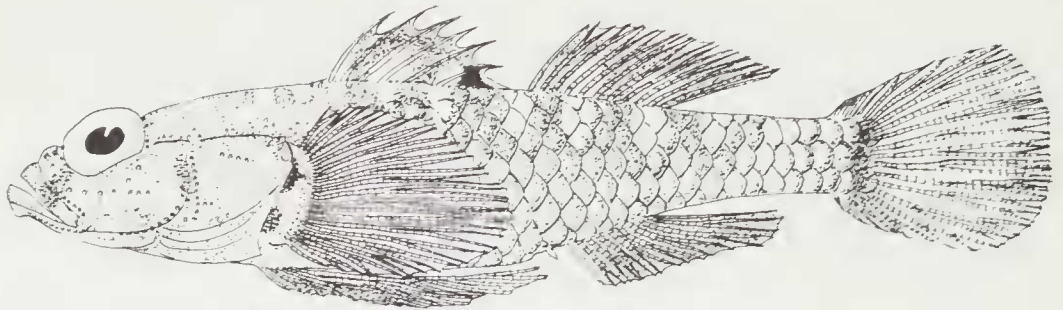


Figure 1. Holotype of *Thalasseleotris adela*, AMS I.17550-010.

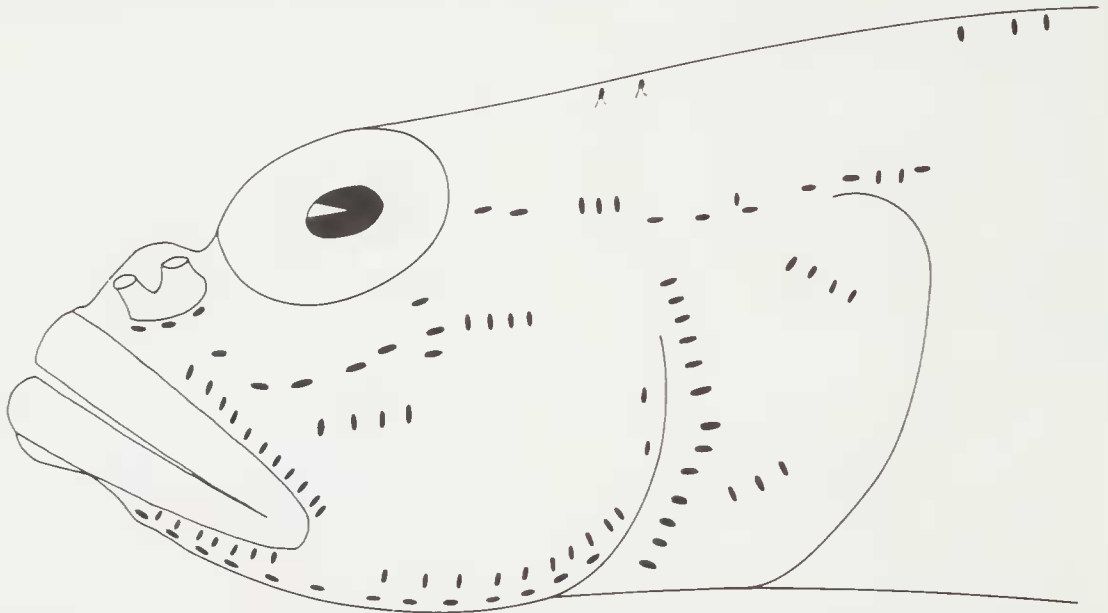


Figure 2. Lateral view of head showing sensory papillae in *Thalasseleotris adela*, based on 25 mm cleared and stained paratype AMS I.18241-035.

27 (Table 1); transverse scale series (TRB) 6(14), 7(5*). Measurements of holotype in mm: SL 23.8, head length 7.9, head width at posterior preopercular margin 5.3, head depth at posterior preopercular margin 4.7, upper jaw length 3.2, snout length 2.0, eye length 2.6, body depth and pelvic origin 4.9, body depth at anal origin 4.7, pectoral length 7.5, pelvic length 7.7, caudal length 6.1, third-dorsal spine length 3.7, fourth-dorsal spine length 3.5, fifth-dorsal spine length 3.7.

Head, pectoral base, breast and prepelvic area naked. Body scales extend forward to line from

upper pectoral insertion to below 4th-6th dorsal spine. Snout short, rounded in dorsal view, slightly less than eye length; prominent bump on snout formed by protrusion of ascending processes of premaxillae, both nostrils at end of short tube, anterior nostril subequal in length to posterior nostril; posterior nostril about 1 nostril diameter in front of eye, anterior nostril slightly less than 1 nostril diameter from upper lip, eyes elevated, shallow groove between and behind eye; interorbital very narrow, eyes almost touching; mouth oblique, angled about 35-40° with body axis; lips thick, jaws reaching posteri-

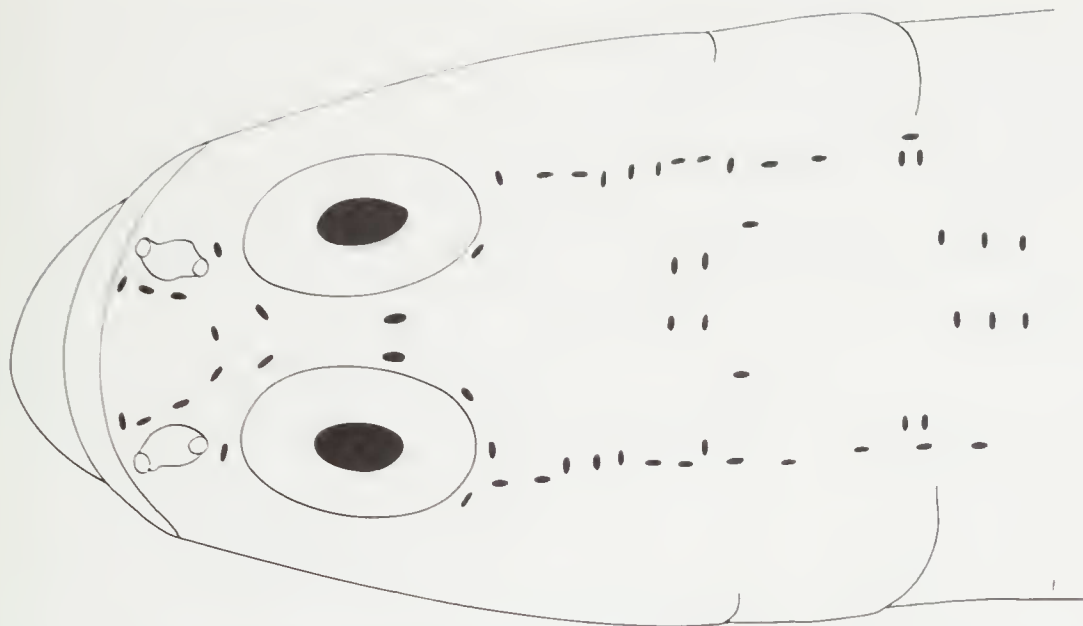


Figure 3. Top view of head showing sensory papillae in *Thalasseleotris adela*, based on 25 mm cleared and stained paratype AMS I.18241-035.



Figure 4. Ventral view of head showing sensory papillae in *Thalasseleotris adela*, based on 25 mm cleared and stained paratype AMS I.18241-035.

only to below anterior margin to middle of pupil; teeth minute, conical, with sharp points, teeth in upper jaw in 4-5 rows anteriorly, tooth patch tapering laterally to 2 rows, teeth in outermost row thicker and slightly longer than teeth in middle rows, innermost teeth anteriorly subequal in length to teeth in outer row; teeth in lower jaw

in 4-6 rows anteriorly, tooth patch tapering laterally to 2 rows, teeth in innermost row longest, teeth in outermost row slightly larger than teeth in middle rows; gill opening very broad, extending forward to below posterior quarter of pupil, gill membranes forming thin and short fold across isthmus; lower limb of first gill arch joined

to inner gill cover by membrane; no spines on operculum; chin with small rounded mental frenum, followed by 2 sensory papillae and with papilla at each side of frenum base. First dorsal fin with broadly rounded margin, third to fifth dorsal spines longest and subequal, fourth or fifth spine often slightly longer than third spine; second dorsal fin subequal in height to first dorsal fin, anal fin slightly shorter in height than first dorsal fin; base of second dorsal fin less than distance from end of second dorsal fin to base of caudal fin; pectoral fins with pointed margin, rays 10-14 (counted from top) longest, fin reaching to above anal fin origin or slightly beyond; caudal fin with rounded posterior margin, fin about two-thirds length of head; separate pelvic fins long, reaching to or slightly beyond urogenital papilla; pelvic rays highly branched, with membranes connecting tips of ray, but with shallow notch between tips of rays; fourth pelvic ray with 7-10 branches in adult, fifth ray with 4-7 branches in adult, fourth ray longest, fifth ray slightly shorter than fourth ray and longer than third ray. Urogenital papilla similar in both sexes, broad at base and tapering slightly distally, with small lobes at tip; males usually with dense concentration of minute black dots covering papilla, distal tip with fringe of minute lobes, lengths of lobes less than one-fifth length of papilla; papilla flattened dorsoventrally. Females with little or no pigment on urogenital papilla, distal end with elongate lobes, lengths about one-third to one-fourth length of papilla; papilla only slightly flattened and more rounded in cross section than that of male.

Sensory papilla; (Figs. 2-4). Lateralis-system papillae prominent on head as short flaps, height of papilla about 1.5 to 2 times width of papilla at base.

Three oval papillae along base of bulbous nasal sac. An LT line of papillae above posterior two-thirds of upper jaw. Irregular LL line from above middle of jaw to below and near posterior end of eye, followed posteriorly by short VT line, followed by LT line of 3 to 5 papillae. Short LT line of 3 to 5 papillae below upper LT line of cheek. Preopercular mandibular series with inner LL line composed of single row of papillae and outer LT line, composed of single row of papillae, with short gap below and just behind posterior end of jaws in the LT line. The preopercular mandibu-

lar series terminates anteriorly at side of chin. Pair of LT papillae at anterior tip of chin. Opercular series with anterior VT line and upper oblique (OT) and separate lower oblique line (OT). LL line from posterior end of eye on nape to just behind operculum interrupted by short sections of LT lines, composed of 1 to 3 papillae, with the LT lines displaced slightly dorsally. Other papillae show on figures 2-4. Little variation noted in 3 cleared and stained specimens examined.

Colour of live female from Victoria (NMV A.3820). Head and body translucent. Dorsal margin of eye with 5 brown transverse bands, as wide as light interspaces; iris gold; pupil reddish-black. Yellowish bar, with minute black dots from anteroventral margin of eye to just behind middle of upper jaw; similar yellowish bar with few scattered minute black dots extending ventrally from eye to posterior margin of jaws; round yellowish spot (subequal to pupil) with dense concentration of minute black spots below posteroventral margin of eye; small (slightly less than pupil diameter) yellowish brown spot at mid-posterior end of preoperculum; top of head with yellowish brown marbling. Small (much less than pupil diameter) spot at upper margin of pectoral base ventroposteriorly to lower pectoral base (band width subequal to pupil diameter). Body with 4 elongate, subcutaneous black blotches along vertebral column, 1 below first dorsal fin, 2 below second dorsal fin and one on caudal peduncle. Faint gray blotch below middle of second dorsal fin. Two minute black spots above anterior half of anal fin, larger black spot above end of fin, 4 slightly larger black spots ventrally on caudal peduncle. Posterior margin of scale edges golden brown. First dorsal fin densely covered with minute black spots, a dense concentration of spots forming vertically elongate black spot at posterior margin of fin below sixth dorsal spine; distal tip of first dorsal fin with thin white margin. Second dorsal fin dusky grey, with thin white distal margin. Other fins almost clear to faintly dusky grey. Vertically elongate black bar behind caudal peduncle on base of caudal fin.

Colour of freshly collected male from Western Australia (WAM P.28293-033). Similar to live

coloration of female, differing in following: lips, eyes, head and pectoral base densely covered with minute black dots. Posterior margins of scales yellowish with dense concentration of minute black dots inside yellowish markings. Yellowish brown spot (subequal to pupil) on upper pectoral base. Dorsal fins densely covered with minute, black dots, giving fin blackish appearance, margins of fins clear. Thin, black, longitudinal stripe at base of first dorsal fin; spot at posterior end of fin black. Anal fin with lower concentration of black dots. Caudal fin clear, but with black vertical bar at base extending onto end of caudal peduncle. Pectoral and pelvic fins densely covered with minute, black dots.

Colour in alcohol. Head and body light to dark brown. Males: Head and body densely covered with minute evenly-spaced black dots, dots denser on top of head and back. Oblique, dark brown bar from anteroventral margin of eye to upper lip; second dark brown, vertical bar from lower margin of eye to posterior end of jaws; short, dark brown, oblique bar from posteroventral margin of eye; bars often obscured by dark head coloration. Dark brown, oval spot in contact with posterior margin of eye. Top of head with very thin, median, longitudinal, black line above front half of operculum; second black, median line immediately before first dorsal spine. Papillae on top of head and nape often with black tips, particularly those immediately before first dorsal fin. Median dark brown, line on caudal peduncle from end of anal fin to base of caudal fin, often broken into a series of short, dark brown lines. Black spot at upper pectoral base dissected by opercular membrane attaching to upper pectoral base. Posterior edges of scales only slightly darker than centres of scales. Fins varying from light dusky grey to almost black. Distal margins of fins lighter than rest of fin, often without pigment. Small, black spot covering most of membrane behind sixth dorsal spine. Dark brown, vertical bar at base of caudal fin. Females: Colour variable. Colour of sensory papilla, vertical bar at base of caudal fin, spot behind eye and spot at upper edge of pectoral base as in males. Minute black dots usually concentrated into spots, mottling and bands; in largest females (over 20 mm SL) dots sometimes uniformly distributed on head and body giving

fish dark brown appearance similar to that of males. In small females (up to 25 mm SL); 3 distinct stripes radiating from eye, 1 from anteroventral margin of eye to and crossing upper lip, second bar extending vertically from eye to below posterior end of jaws, third bar extending almost vertically from posteroventral margin of eye to lower edge of preoperculum; rest of preoperculum and operculum with irregular mottling; top of head with mottling forming 2-4 irregular transverse bands, often darkest at edges; minute, black dots on body concentrated along posterior edges of scales, back often with series of short, oblique (sloping ventroposteriorly) broad, dark brown bars; first band below anterior part of first dorsal fin, second band below posterior end of first dorsal fin, 2 bands below second dorsal fin and 2 bands on caudal peduncle, last band often extending ventrally to lower edge of caudal peduncle, bands on back extending dorsally as oblique bands on to dorsal fins, third oblique band at end of second dorsal fin above first caudal peduncle band; pectoral fin with dark brown, vertical bar anteriorly, followed posteriorly by light area; fins generally translucent, except for oblique bands on dorsal fins and blackspot behind sixth dorsal spine; pectoral fin often with dark brown irregularly shaped spot dorsally near bases of rays. In some larger females, head, body and fins dark brown as in males, but banding on back and on dorsal fins usually discernible.

Distribution and habitat. From Sydney, New South Wales through Victoria, Tasmania and South Australia, to Rottneest Island, Western Australia. Restricted to rocky reef environments, often in silty turbid waters; 1-24 m.

Etymology. From the Greek *adelos* (dini or obscure), referring to its cryptic and often dark habitat.

Remarks. *Thalasseleotris adela* shows considerable geographical variation in pectoral-ray counts (Table 1). Counts from specimens from New South Wales and Western Australia are lower than those from specimens from other states. Analysis of variance, using multiple comparison methods (Scheffe, 1959) indicate that the means from New South Wales and Western Australia do not differ significantly from one another, but

Table 1. Pectoral ray counts and longitudinal scale series counts of populations of *Thalasseleotris adela* from southern Australia.

Pectoral Rays:	Counts					Mean	Variance	
	17	18	19	20	21			
New South Wales	1	14	10	1	—	18.4	0.41	
Victoria	—	—	1	6	4	20.3	0.42	
Tasmania	—	—	10	14	6*	19.9	0.55	
South Australia	—	1	2	3	5	20.1	1.09	
Western Australia	2	6	11	7	1	19.0	0.96	
Longitudinal scale series	22	23	24	25	26	27		
New South Wales	—	3	4	2	—	—	23.9	0.61
Victoria	—	—	1	3	1	1	25.3	—
Tasmania	—	3	7	7	3	1*	24.6	1.14
South Australia	—	—	1	2	—	—	24.7	—
Western Australia	5	3	3	—	—	—	22.8	0.76

both differ significantly from all other southern states ($p < 0.01$). A similar trend also occurs in the longitudinal scale counts (Table 1), but counts were obtained from few specimens, since many had lost scales. Analysis of variance including only samples from New South Wales, Tasmania and Western Australia indicated a highly significant difference between Western Australia and Tasmania ($p < 0.001$). These trends are most likely correlated with temperature, with the lowest counts occurring in the warmest areas, north of 35°S.

Colour varies considerably, usually with large males being darker and more uniformly coloured than females. Small individuals may be very pale. Since the fish apparently can lighten and darken in life, some variation is undoubtedly related to their habitat.

Acknowledgments

We thank J.B. Hutchins and R. Kuitert for providing much of the material and photographs of live and fresh specimens used in this study. L. Moody assisted with drawings of papillae.

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